OUR COMMON FUTURE UNDER CLIMATE CHANGE

International Scientific Conference

ABSTRACT BOOK

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This Abstract book is based on a compilation of all abstracts selected for oral and poster presentations, as of 15 May 2015.

Due to the inability of some authors to attend, some of those works will therefore not be presented during the conference.

OUR COMMON FUTURE UNDER CLIMATE CHANGE

Welcome to the Conference

Welcome to Paris, welcome to 'Our Common Future under Climate Change'!

On behalf of the High Level Board, the Organizing Committee and the Scientific Committee, it is our pleasure to welcome you to Paris to the largest forum for the scientific community to come together ahead of COP21, hosted by France in December 2015 ("Paris Climat 2015").

Building on the results of the IPCC 5th Assessment Report (AR5), this four-day conference will address key issues concerning climate change in the broader context of global change. It will offer an opportunity to discuss solutions for both mitigation and adaptation issues. The Conference also aims to contribute to a science-society dialogue, notably thanks to specific sessions with stakeholders during the event and through nearly 80 accredited side events taking place all around the world from June 1st to July 15th.

When putting together this event over the past months, we were greatly encouraged by the huge interest from the global scientific community, with more than 400 parallel sessions and 2200 abstracts submitted, eventually leading to the organization of 140 parallel sessions.

Strong support was also received from many public French, European and international institutions and organizations, allowing us to invite many keynote speakers and fund the participation of more than 120 young researchers from developing countries. Let us warmly thank all those who made this possible.

The International Scientific Committee deserves warm thanks for designing plenary and large parallel sessions as well as supervising the call for contributions and the call for sessions, as well as the merging process of more than 400 parallel sessions into 140 parallel sessions. The Organizing Committee did its best to ensure that the overall organization for the conference was relevant to the objectives and scope. The High Level Board raised the funds, engaged the scientific community to contribute and accredited side events. The Conference Secretariat worked hard to make this event happening. The Communication Advisory Board was instrumental in launching and framing our communication activities on different media. We are very grateful to all.

We very much hope that you will enjoy your stay in Paris and benefit from exciting scientific

interactions, contributing to the future scientific agenda. We also hope that the conference will facilitate, encourage and develop connections between scientists and stakeholders, allowing to draw new avenues in the research agenda engaging the scientific community to elaborate, asses and monitor solutions to tackle climate change together with other major global challenges, including sustainable development goals.

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different ecosystems in different ways, depending on the complexity and original characteristics of the system, geographical location and presence of factors that may regulate the extent of the changes. In southern Africa in general and Zimbabwe in particular, there is still paucity of scientific understanding of climate change's impact on vegetative species diversity specifically species richness and evenness. A plethora of studies have claimed that climate change affects biodiversity but without focusing on specific diversity indices. This poses challenges when designing adaptive and mitigative strategies that are ecosystem and species specific. This study assesses the effects of climate change on vegetative species diversity in Mutirikwi sub-catchment using the Normalised Difference Water Index (NDWI).

To achieve the research objective, the relationship between vegetative diversity indices (richness and evenness) and climatic variables (rainfall and temperature) was explored based on species data directly collected from the field over a 3 year period and climate data collected from three local stations (Makoholi, Masvingo airport and Buffalo range). Relationship between NDWI and species diversity indices was examined to confirm the utility of remote sensing in predicting vegetative diversity. NDWI was calculated using the formula:

NDWI=(□NIR−□SWIR)/(□NIR+□SWIR).

Where □NIR and □SWIR are the reflectances of the near-infrared (NIR, 0.78-0.89 m) and shortwave-infrared (SWIR, 1.58-1.75 m) regions, respectively.

The species diversity indices were calculated using the Shannon Weaver Index which usually combines aspects of richness and evenness. This index was calculated using the formula:

H = −Σ (Pi In (P) Where the summation is over all species and P1 is the relative abundance of species in the quadrat. This index measures the average degree of uncertainty in predicting to what species chosen at random from a collection of S species and N individuals will belong. Species evenness (E) was calculated using the formula:

E= H/In (S) Where H is the Shannon Weaver index and S is species richness observed within the quadrat.

The resultant predictive model was used to estimate changes in species diversity over a 40 year period (1974-2014). The species diversity data was then regressed with climatic data for the same period. These data were also modelled to project future changes in vegetative diversity in the face of climate change.

Preliminary findings reflect a significant ($P<0.05$) correlation between species diversity and climatic variables. The results also indicate that there is a significant ($P=0.003$; $\alpha=0.05$) relationship between species richness and NDWI. Species evenness was also significantly correlated ($P=0.04$, $\alpha=0.05$) with NDWI. This implies that we can use NDWI to assess changes in species diversity over time. The Mann Kendall test revealed a significant decrease in the rainfall received within the catchment over the 40 year period (1974-2014). The minimum and maximum temperatures over the period were significantly increasing. These changes in climatic variables were matched with a decrease in species richness and evenness. Some species tend to be succumbing to the environmental changes influenced by climate change resulting in their changes in phenology, abundance and distribution.

The study concludes that climate change in Mutirikwi sub-catchment is influencing species diversity through changing species phenological features, abundance and distribution. Besides being a good indicator of water content in leaves, NDWI has proved to be a useful indicator of species diversity. The study leads to the understanding of the relationship between vegetative species diversity and climate change and this provides a platform for nations to devise strategies to enhance the resilience of ecosystems to climatic changes through the adoption of species based adaptive and mitigative strategies.

P-3330-15

Responding to Climate Change Challenges in Sub Saharan Africa - A case for Water Supply

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Change is a permanent phenomenom in all spheres of life. Many a time changes present both opportunities and threats on diffent facets. For sustainability, we need to constantly anticipate changes and their impact. Some changes come with heavy impact. Climate change is one of them. It has spiral effect on several frontiers of human existence. It is one phenomenom that derseves urgent attention. Based on risk assement, we need to take proactive steps to either eliminate adverse impacts or mitigate them or compensate for the perceived impacts. Sometimes changes present beneficial opportunities. In dealing with changes, time of reaction and availability resources are vital.

Sub Saharan Africa Countries are presently existing on fragile economy. Population is increasing while social infrastructures are dwindling. This presentation outlines the challenges of dealing with climate change in Sub Saharan Africa. It analysis the following issues as it relates to climate change

- Threats of climate change
- Opportunities occassioned by climate change
- Capacity to respond to climate changes
- Effect of climate change
- Consequence of climate changes in Sub Saharan Africa
- Strategy to coping with climate change challenges
- Risk identification
- Stakeholders communication strategy

The paper asserts that Sub-Saharan Africa remains the most vulnerable region in Africa due to inherent poverty and lack of clear policies on dealing with climate change. Climate change will have adverse impacts leading to decreased food production, displacement, increased poverty, conflicts and reduction in production capacity in the region. Although, some parts of Sub Saharan Africa will experience increased agricultural production as a result of increased rainfall but there exist little capacity to take maximum advantage of the opportunity or mitigate the adverse impact of excessive rainfall. Generally, climate change portends a bleak future for Sub Saharan Africa. The paper posits that Sub Saharan Africa countries need to take urgent actions towards tackling the threats of climate change and plan on take advantage of emerging opportunities.

The paper elicites that climate change challenges in Sub Saharan Africa will adversely affect other regions of the world in one way or the other.

P-3330-16

The impact of global changes on agriculture: the case of Ivorian Basin of Comoe River

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Since some decades, the Ivorian Comoe river Basin faced environmental and climatic changes. As one of rainfed agriculture leading forces, climate conditions display (here) a major role in agriculture transformations. The simulation of water need requirements, coupled with farming systems, shows that actual global changes mainly benefit to annual crops such as corn (Zea mays), and allows the upgrading of the trees crop as cashew (Anacardium occidentale), rubber tree (Hevea brasiliensis), etc. However, the precariousness of the production systems, whose practices have not deeply changed, has to be linked with the combined effects of land saturation, agricultural policies and need of cash faced by farming communities. Therefore, the diversification and reconversion toward rubber plantation, are to be considered as farmers' strategies aiming at finding alternatives for old speculations such as coffee

(Coffea L.) and cocoa (Theobroma cacao L.). For instance, the countryside has been gripped by a frenzy of agricultural development of Chromolaena Odorata and wetlands, which were previously not cultivated. These changes go with intense competition for land that benefits some urban elite who, in example, seeks to cope with retirement by investing in rubber plantation (Hevea brasiliensis). We are witnessing social and spatial reconstructions that, in view of the uncertainty of present conditions, leave small room for environmental protection. The present survey analyzes the ongoing processes, speculates on their future development, and suggests some ways for sustainable agriculture.

P-3330-17

Impacts of climate variability and agricultural intensification on the origin of runoff: the case study of the watershed Kolondieba in the south of Mali

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As part of the international research program RIPIECSA (Interdisciplinary and Participatory Research on Interactions between Ecosystems, Climate and Society in Africa), watershed Kolondieba (under Sudanese climate) was selected to understand the mechanism of runoff process in order to improve hydrological model in a context of strong climate variability and agricultural intensification (cotton culture is the main economic activity in the basin). The method used is based on rainfall, hydrometric, geochemical and piezometric data monitoring over the period 2009-2011. The results showed that 2009 and 2010 were normal rainfall years (1300 mm, in average), compared to the average of chronic 1960-1969 (wet period), while 2011 has emerged as a dry year compared to the chronic 1970-1992 (dry period). During the last contrasted two years, the runoff coefficient has decreased by half from 2010 to 2011 occasioned groundwater discharge deficit estimated at 33%. Monitoring the mineralization of targeted water compartments: rainfall, surface water, and groundwater with the integrator chemical parameter (Electrical Conductivity), showed a very little mineralization of rainfall with an average of 16.99 ± 8.53 µScm-1. Mineralization of surface water is closer to the rainfall's, but it's far from the groundwater's consist of shallow aquifers and deep ones with respectively 120.58 ± 90.07µScm-1 and 133.57 ± 85.68 µScm-1 in average. This chemical relationship between water compartments showed that deep aquifers don't contribute enough to the runoff. This allowed to deduct a double origin of the runoff on the watershed consists of stormflow and subsurface flow. The separation of the hydrograph in a normal year (2010) gave a contribution of stormflow about 77%. This contribution has increased by 3% in dry year (2011). In these conditions runoff doesn't depend only on rainfall variability, it can be assigned to the land use because cotton culture area is increasing on the basin since 1960.

P-3330-18

Climate projections in West Africa: evidence and uncertainties?

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The Subsaharan Africa response to global warming was uncertain in the models of the third phase of the Coupled Model Intercomparison Project (CMIP3) used for the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC), which even disagree on the sign of future rainfall anomalies over this region. This disagreement remains even among models that correctly simulate the twentieth-century West African climate. Our study investigates results from a new ensemble of state-of-the-art climate modelswhich participated of the fifth phase of CMIP (CMIP5) and raises several questions. Do the models agree more on Subsaharan Africa rainfall projections ? Do they well simulate the partial rainfall recovery observed over the last decades ? How well are models able to reproduce the main features of the West African Monsoon (WAM) ?

Preliminary results of twelve CMIP5 models have shown, in despite of great progress in the representation of MAO characteristics, little changement on their climate projections on West Africa compared to CMIP3. Robust tendancy to warming over the Sahel, larger by 15 to 50% compared to global warming is noticed. The spread of models projections remains very large for both temperature and precipitations. But the dispersion in surface air temperature is large over the Sahel and Sahara and seems to be linked to the radiative aerosols properties and surface albedo in this region. Most of CMIP5 models project increasing temperature with 1.8-4.2°C amplitude in a rcp4.5 scenario (3.5-8.5°C in a rcp8.5) in Western Sahel (15°W-5°W) ; these values being slightly higher in Eastern Sahel (10°E-35°E). The uncertainty temperature changes will have dramatic consequences as those associated with precipitation. An opposite response between the western and eastern Sahel for rainfall projections seems to be robust. However, some « outliers models » predict rainfall increase which cancels part of the Sahel warming during the summer monsoon. This finding on the western Sahel gathers more and more models as we advance into the 21st century: 40% for the period 2011-2040, 60% for the 2041-2070 period and more 80% in the last period. In contrast, the eastern Sahel, although the consensus model is relatively high, it decreases by 80% in the first period to 70% in the last period. The rcp4.5 scenario shows precipitation oscillations around a mean value (positive for the first zone/negative for the second) as well in the East and the West of Sahel, indicating a high interannual variability ; while rcp85 scenario gives a tendency net increase of abnormal rainfall in the eastern reaches 100 mm at the end of the 21st century. A particular domain (5°W-10°E), encompassing western Mali, Burkina Faso, northern Nigeria and eastern Niger, where consensus between the models is low on changing rainfall for two scenarios have been charachterized.

Finally, our study indicates that further investigations on the rainfall response mechanisms in these outliers models should help to assess their credibility and need to be explored.

P-3330-19

Why is the « Sahelian paradox » recently exacerbated?

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During the Great Drought that West Africa suffered at the end of the 20th century, hydrological observations highlighted an increase in runoff only in the Sahel, although this was the area where the rainfall deficit was the highest. From the small experimental plot to the major tributaries basins of the main rivers, runoff coefficients and discharges values increased significantly during the dry period. This was named the «Sahelian Hydrological Paradox». From the very end of the century, after 1995, rainfall generally increased again in the whole West Africa. Therefore, an increase in runoff afetr 1995 is easy to explain. However the increase in runoff and discharges valuesbegan in 1970, at the very beginning of the Great Drought; the hydrological behavior of Sahelian surfaces remains thus paradoxical at least from 1970 to 1995. Thus its recent exacerbation is not such paradoxical, yet needs to be explained.

The more commonly cited Sahelian paradox explanation is the widespread soil crusting through the Sahel. It is considered as a consequence of the extension of crops, leading to a quasi-disappearance of natural bushes. This trend was accompanied by a decrease in fallowing, the main fertility restoration practice used in the Sahel. After 3-4 years of cropping, a 8-10 years fallowing was traditionally practiced. The population increase and subsequent food needs progressively led to the